Planetary Polarization Nephelometer

Completed Technology Project (2016 - 2019)

Project Introduction

The aerosols that reside in the atmospheres of the Giant Planets, Venus and Titan are the visible faces of these planets, and yet we have quite limited knowledge of them. The impact of this lack of knowledge is significant on our understanding of the composition, structure and dynamics of these planetary atmospheres. For the Giant Planets, remote sensing cannot adequately identify even the level at which the clouds that form the familiar shapes reside. Consequently, we only roughly know the level of deposition of solar energy or the altitude at which the tracked winds reside. For Venus, an unknown blue absorber contributes a significant amount to the energy balance of the middle atmosphere. Only by studying the aerosols of these atmospheres in situ will we be able to characterize their properties with sufficient precision to move forward in answering many of these questions. Our proposed Planetary Polarization Nephelometer will supply more complete information on the size, shape, number density and chemical composition than any other cloud particle instrument proposed for planetary (or terrestrial) use. Our proposed instrument has already benefitted from three years of PIDDP funding, where the instrument went from just an idea to a proven capability using bench-top hardware. We now sit at TRL3 and have a well-developed plan to reach TRL 5 at the end of 3 years of work. We will first build component-level maturation demonstrations of the key technologies (i.e., laser drive modulators, receive-side optics and fibers, detector linear array control and readout) and then work to integrate these all into a prototype that will be tested under appropriate environmental conditions. We will not seek to make this prototype flight qualifiable itself, but we will fabricate it using components that have a clear path to flight. The proposed instrument development is relevant to the PICASSO Program because it seeks to mature low TRL instrument technology (TRL 3 in our case) that would be applicable to several potential near-future missions fro the Planetary Decadal Survey: Saturn Probe, Venus In Situ Explorer, Venus Climate Mission, Uranus Orbiter and Probe. It would also have good impact as part of a Titan in situ mission or the Comet Surface Sample Return, as well as Mars or Moon in situ missions. Our technical maturity and well-developed plan for reaching TRL5 (and minimizing the stretch to TRL6) would position this instrument well for upcoming future missions.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Planetary Instrument Concepts for the Advancement of Solar System Observations

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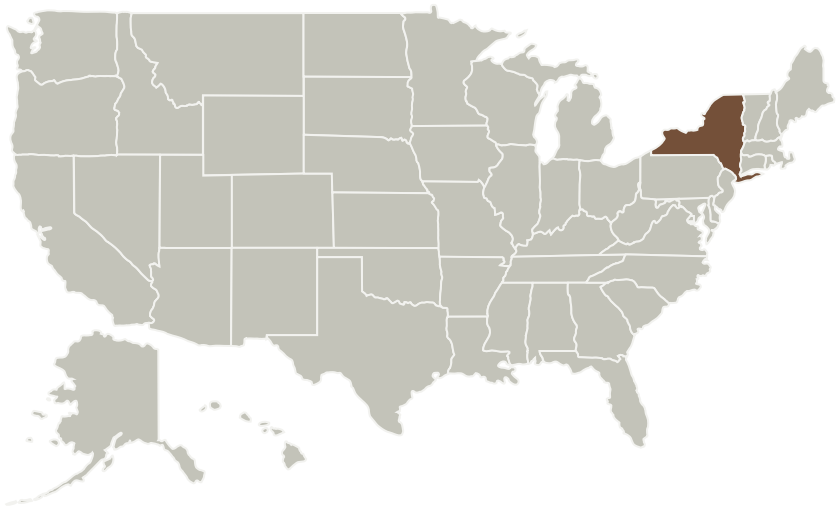
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Cornell University	Supporting Organization	Academia	Ithaca, New York

Primary U.S. Work Locations
New York

Project Management

Program Director:
Carolyn R Mercer

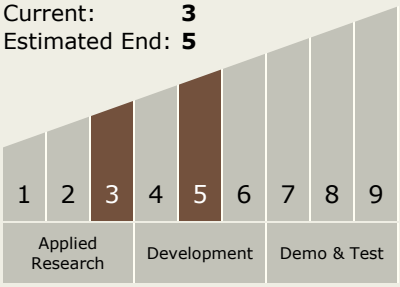
Program Manager:
Haris Riris

Principal Investigator:
Donald J Banfield

Co-Investigators:
Joseph Gerardi
Brenda M Truesdail

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

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Target Destination

Others Inside the Solar System